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as showing what has been done on this side of the Atlantic, and it is earnestly desired by the council of the Royal Photographic Society that the United States should continue to be fully represented in this exhibition.

C. E. K. MEES

KODAK PARK,  
ROCHESTER, N. Y.

#### THE CARNEGIE FOUNDATION

THE president of the Carnegie Foundation for the Advancement of Teaching has printed and distributed a long discussion of the policies of the foundation. Although this has been sent to thousands of teachers it is curiously, but characteristically, marked "Confidential." As it can not be discussed directly, the writer has reprinted the articles on the subject which appeared in *SCIENCE* several years ago and will be glad to send a copy to any reader of this note who may care to ask for it. It is desirable at least to watch the Greeks, both when they bear gifts and when they take them away.

J. McKEEN CATTELL

GARRISON-ON-HUDSON, N. Y.,  
April 15, 1916

#### SCIENTIFIC BOOKS

*The Telephone and Telephone Exchange, Their Invention and Development.* By J. E. KINGSBURY, M.I.E.E. Longmans Green & Co. 1915. Cloth. 558 pages, 170 illustrations. Price \$4.00 net.

Considering that the telephone, in its serviceable form, is an American invention; that the telephone switchboard and exchange were first developed in America, and that the number of telephones per unit of population is much greater in America than in any other part of the world, it is remarkable that this is the first book that pretends to give a comprehensive outline of the history of telephonic development, and that this first book should have been written in England. This is an index of the general condition of inventors, engineers and engineering, all the world over. As a body, engineers are rarely gifted with talents for literature, or for historical re-

search; yet collectively, they have transformed the surface of this planet, and have revolutionized its modes of living. However, if one should ask of a local resident near some monumental structure, grand bridge, or imposing viaduct, as to who erected it, the answer would be likely to be limited to the name of a capitalist.

This book traces very entertainingly the development of the Bell telephone, from its early conception in the mind of the inventor, to the standard instrument on so many a table of to-day. The author modestly disavows the title "history" for his book. Nevertheless, a very large amount of historical research must have been carried on by him, in order to make up the interesting narrative contained in these pages.

The following list of chapter headings will convey an idea of the scope of the historical work: Introductory, The spoken word, The growth of an idea, The undulatory current, The solution of the problem, Development and demonstration, The production of a commercial instrument, The application to commercial uses, The telephone exchange, The battery or variable-resistance transmitter, The microphone, Philipp Reis and his work, Call bells, The telephone switchboard, The organization of the industry in the United States, Competition, Consolidation and development, Introduction of the telephone in Europe and abroad, Public apathy and appreciation, The multiple switchboard, Outside or line construction, Ten years' progress, The Development of dry-core cable, Early exchange systems, Telephone engineering on a scientific basis, The branching system, The common-battery system, Automatic and semi-automatic switchboards, Long-distance service, Instruments, Rates, The economics of the telephone, The telephone and governments, Conclusion.

The task of considering the invention and development of each individual element in a modern telephone system is a very difficult one. There are so many claimants, and their claims are so antagonistic. The author has carried out this task in his own way, and with a fairmindedness that merits approbation. It

may be urged that, in America, he has not done full justice to the work of the independent telephone companies and their inventors. The great bulk of the development in this country is undoubtedly due to the Bell organization, its pioneers, inventors, organizers, engineers and constructors; yet a very appreciable residual share is due to the competing independent companies. It must be remembered, however, that the author has not had the same opportunity to become acquainted with ultra-Bell sources in America, that he has in Great Britain, but there he has given credit with an impartial pen.

The chapter on the telephone and governments should be studied by those who, as outsiders in telephony, seek to form a just estimate of the relative advantages of governmental versus private-corporation administration. The author knows whereof he speaks, for he has been in intimate touch with telephony in England, both under company operation, and under government operation. He also writes in a fair and open-minded vein. The conclusion which is apparently unavoidable is that governments are not able to operate a country's telephone system so efficiently, economically or progressively as a private corporation under government control. For this conclusion, there is certainly abundant evidence. In Europe, where the governments almost invariably operate the systems, the only country in which it appears that the telephones are in private hands, is Denmark. Denmark is accorded 4.5 telephones per hundred of population; whereas the highest use in any government-operated country is 2.1 (for the German Empire). In the United States, the number given is 9.7 per hundred, or more than double Denmark's.

The book is almost the only history of its kind, and is a welcome addition to the literature of telephonic growth and development.

A. E. KENNELLY

*An Introduction to the Principles of Physical Chemistry.* By EDWARD W. WASHBURN. New York, McGraw-Hill Book Co., Inc., 1915. Pp. xxv + 445.

This volume constitutes a marked departure from the conventional method of treatment which most authors have followed under the influence of the early spirit of physical chemistry which found concrete expression in Ostwald's "*Lehrbuch der allgemeinen Chemie*." Many years have elapsed since this epoch-making work appeared and many important contributions have been made to our knowledge of the subject in the meantime. The controversies, however, which arose in the early development of physical chemistry, have been so prolonged that most writers have confined themselves to the outline of the subject as established by precedent and have found little opportunity to lay before the student the more recent developments in this field. In this respect the present volume is a welcome addition to the literature. The treatment of the subject is distinctly along original lines.

The book is well written, and the subject-matter is presented in a manner which retains the interest of the reader. A large number of very excellent figures are given, many of them being original. The numerous problems appearing throughout the text are well selected. The biographical references will prove of interest to the student. A later edition should give reference, however, to Mayer, Joule and Helmholtz, in connection with the first law of thermodynamics. The reference to J. Willard Gibbs as "one of America's greatest chemists," fails to recognize the importance of Gibbs's work along other lines than those of chemistry. References to the literature are numerous and add greatly to the value of the text. Cross references are frequent, but references to page and section would be more convenient than references to chapter and section. Misprints and other minor defects are much less common than is usual in first editions.

The division of the subject-matter is excellent, on the whole, but it is to be noted that the greater portion of electrochemistry is omitted. Gaseous equilibria, in fact, equilibria in general, with the exception of electrolytic equilibria, are treated very briefly. The Nernst heat theorem is not mentioned, al-